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FOR A STANDARD PATENT**

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Invention Title: INSECT KILLING APPARATUS

Details of Associated Provisional Applications:

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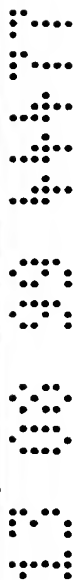
The following statement is a full description of this invention, including the best method of performing it known to us.

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ABSTRACT

Apparatus for and methods of killing flying insects comprising attracting insects into a controlled environment and drowning the insects in a liquid solution. The attractant can include CO₂ gas and the liquid solution can be a water based solution.

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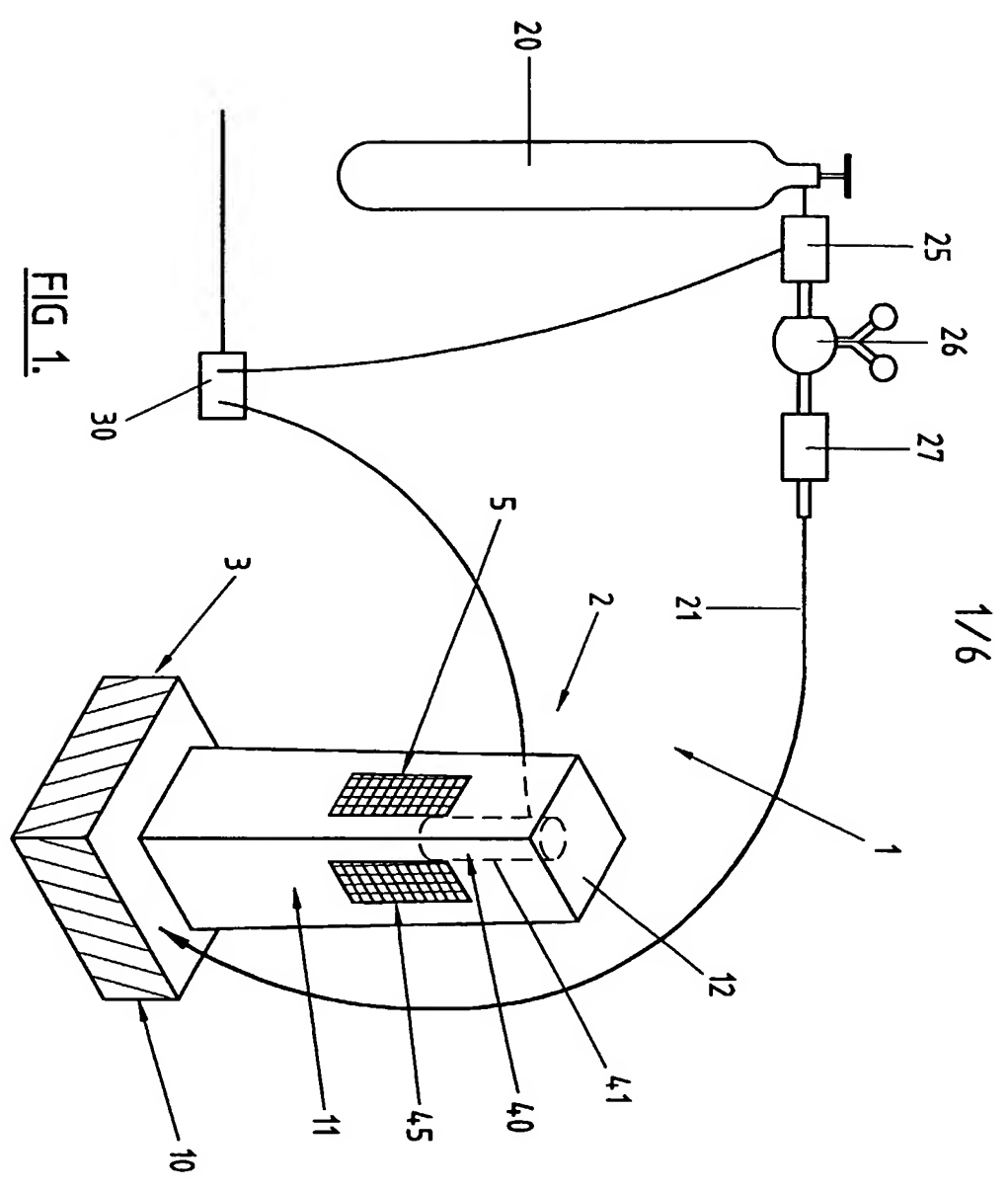


FIG 1.

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INSECT KILLING APPARATUS

TECHNICAL FIELD

This invention relates to apparatus for killing flying insects.

BACKGROUND ART

5 Flying insects such as mosquitos and midges often cause irritation and discomfort to people in outdoor entertainment areas. This is particularly so where the entertainment are located in proximity to water, eg canals and waterways and rivers, and the area generally has a warm moist climate. The midges and mosquitos are particularly troublesome in the early
10 evenings when a lot of outdoor entertaining is traditionally undertaken. The problem is major and while devices have been proposed to overcome the problem none has been totally satisfactory. It would therefore be highly desirable if a device could be devised for effectively killing these insects in sufficient numbers that they ceased to pose an irritation and discomfort
15 problem.

DISCLOSURE OF INVENTION

According to one aspect of this invention there is provided apparatus for killing flying insects including:

- 20 a container having a side wall and defining at least one opening in the side wall;
- means for attracting and drawing flying insects into the container in through the opening; and
- a liquid receptacle positioned towards the bottom of the container for drowning insects caught within the container.

25 Thus the apparatus works by luring insects, eg mosquitos, midges and sandflies into the container, then drowning the insects when they tire after being asphyxiated through lack of oxygen.

Typically the attracting means includes CO₂ gas.

30 Preferably the attracting means also includes a liquid which is a water based solution including a sugar, eg fructose or sucrose and optionally also chlorophyll, through which the CO₂ gas is bubbled or percolated.

Typically the water based solution also includes a surfactant for

reducing the surface tension of the solution such that the insects easily fall through the surface and drown in the body of the solution.

Advantageously the solution is contained in the receptacle at the bottom of the container in which the insects are drowned.

5 Thus in a preferred form the solution or brew draws insects into the container where they are subjected to asphyxiation causing disorientation which leads to them falling into the same solution and drowning.

Typically the attracting means also includes a light, eg a black or red light or optionally a combination of the two within the housing.

10 Typically the light is positioned substantially centrally within the housing.

Typically the at least one opening in the side wall comprises at least one cluster or array of closely spaced small openings defined in the side wall of the container. Typically each aperture is 5 to 10 mm in diameter.

15 Typically there will be clusters of openings on at least two opposed wall portions, preferably all four wall portions of a rectangular wall.

Alternatively the least one opening may be formed by at least one larger window like opening in the side wall with gore or mesh stretched across the opening to define a plurality of small openings. Typically the gore mesh openings are also about 5 to 10 mm in diameter.

20 The openings must be sufficiently large to let insects easily into the container and to allow gas to flow out of the container thereby to keep the ingress of oxygen into the container at a suitably low level.

Optionally the apparatus may include a cylinder containing liquid CO₂ for providing the CO₂ gas to the container. The cylinder is typically
25 coupled to a conduit which is passed into the solution in the receptacle in the container such that emitted CO₂ bubbles through said solution.

Typically the CO₂ cylinder and conduit include means for opening and shutting the flow of CO₂ gas into the container. Typically the opening and shutting means includes a solenoid, and optionally also a flow
30 valve and a regulator positioned on the conduit.

Preferably the device also includes a timer operatively connected to the opening and shutting means for causing CO₂ to flow into the

container only at certain specified times of the day. Typically the CO₂ flow to the container is opened in the early mornings after sunrise, eg for about 3 ½ hours from 4.00 a.m. to 7.30 a.m. in the morning. The CO₂ flow may also be opened at other times of the day depending on the specific environment in which the apparatus is located.

In some forms the bottom of the container is easily detachable from the remainder of the container, eg to facilitate periodic cleaning out of the receptacle. For example each of the bottom and the remainder of the container may have complementary engagement formations such that they can engage each other by means of a press fit or friction fit.

In other forms the container may have an open bottom and be simply received in an upwardly opening said receptacle which is a tray. In this form there is no positive attachment between container and tray, the container merely resting in the tray with the solution forming a seal.

In yet other forms the tray is integral with the container the tray being formed by the bottom and lower portion of the container. In these forms a lid is removably mounted on the container.

In one form the container is a rectangular box having its long axis extending in a vertical direction. Typically the box is made out of a plastics material although it will be clearly understood that other materials may also be used. Advantageously the box material is also fire proof.

Where the container is a square rectangular box, the openings are typically defined in at least two opposing sides of the container, preferably four sides of the container.

Conveniently the container may also include a power grid and a grill, eg what is known as a "zapper", for assisting in killing flying insects which have entered the container. Heat from the light and power grid also assist in warming up the solution making it more volatile assisting in its diffusion into the surrounding atmosphere.

According to another aspect of this invention there is provided apparatus for killing flying insects including:

a container defining at least one opening;

means for attracting flying insects into the container through the opening; and

means for drowning the insects in the container.

Typically the apparatus also includes means for disorientating the insects in the container. Typically the disorienting means includes CO₂ gas in the air within the container which subjects the insects to asphyxiation.

Typically the container is closed and the attracting comprises a liquid brew having an odour which diffuses into the air outside the container.

Preferably the brew is a liquid solution of water and sugar.

Advantageously the means for attracting insects includes CO₂ gas, eg which is bubbled through the liquid solution so that it acquires taint from the liquid.

Typically the means for drowning the insects comprises a body of liquid positioned below the region of the container for receiving the flying insects and liquid solution also forms the body of liquid within which the insects are drowned.

According to yet another aspect of this invention there is provided a method of killing flying insects including:

Luring and/or drawing flying insects into a container;

Disorientating the insects in the container; and

Drowning the insects in the container.

According to yet another aspect of this invention there is provided an attractant for use in attracting and killing flying insects, the attractant including a water-based solution containing sugar.

Advantageously the sugar is a fructose or sucrose sugar which is dissolved in the water. Advantageously the Attractant includes CO₂ in the form of CO₂ gas is bubbled through the water.

Advantageously the solution also includes a surfactant and chlorophyll.

Apparatus for killing flying insects in accordance with the invention may manifest itself in a variety of forms. It will be convenient to hereinafter describe in detail five preferred embodiments of the invention with

reference to the accompanying drawings. It is to be clearly understood however that the specific nature of the following description does not supercede the generality of the preceding broad description. In the drawings:

5 Figure 1 is schematic three dimensional view of apparatus in accordance with a first embodiment of the invention;

Figures 2(a) to (d) are various views of a container and receptacle for apparatus in accordance with a second embodiment of the invention;

10 Figures 3(a) and (b) are respectively sectional front and external front views of the apparatus of figure 2;

Figures 4(a), (b) and (c) are various views of a container and lid for apparatus in accordance with a third embodiment of the invention;

15 Figure 5 is an assembled sectional front view of the apparatus of figure 4;

Figures 6(a) and (b) are front views of a container and receptacle for apparatus in accordance with a fourth embodiment of the invention;

20 Figure 7 is an assembled sectional front view of the apparatus of figure 6;

Figure 8 is an exploded front view of apparatus in accordance with a fifth embodiment of the invention; and

Figure 9 is a sectional front view of the apparatus of figure 8.

 In figure 1 reference numeral 1 refers generally to apparatus for killing flying insects.

25 The apparatus 1 comprises broadly a container 2, a receptacle 3 within the container 2 carrying a liquid which attracts flying insects, and openings 5 for admitting insects to the container 2.

 The container 2 is in the form of an elongate rectangular box having its long dimension extending in a vertical direction. The container 2
30 has an open bottom which is received in a receptacle 3 as shown in the drawing.

 The receptacle 3 comprises an open topped tray or the like. In

one form the tray is made of aluminium although it will be readily appreciated that other materials may also be used.

The tray contains a solution of water, sucrose and surfactant and typically also chlorophyll. When the apparatus is operational CO₂ gas is bubbled through the solution. The surfactant lowers the surface tension of the liquid so that when insects fall into the liquid they pass through the surface into the body of the liquid and drown.

The insect attracting properties of the solution or brew are obtained collectively by the sucrose and CO₂ gas. This odour or attractant diffuses out of the container 2 and draws insects from the surrounding environment. In actual fact the attractant is effective in luring insects from a considerable distance away from the container 2 to the container.

The CO₂ gases supplied from a CO₂ gas bottle 20 spaced from the container 2. The gas bottle 20 is operatively connected to the container 2 by means of a gas pipe 21. Associated with the gas pipe 21 and gas bottle 20 are a solenoid 25, regular 26 and flow valve 27 for controlling the flow of gas to the container 2. The CO₂ pipe 21 is passed into the solution in the tray 3 such that CO₂ gas bubbles upwardly through the solution.

A timer 30 is operatively connected to the solenoid 25 such that the CO₂ flow through the container can be pre-set to be conducted at certain time of the day. Timers of this nature are well known in the art and will not be described in further detail in this specification.

In the illustrated embodiment there are four rectangular openings 5 in the side wall 11 with a gore 45 extending across the openings 5. The gore 45 openings have a diameter of 5 to 10 mm. The gore 45 must be large enough to permit insects to enter therethrough.

A black light 40, is also located within the container 2. The light 40 is disposed substantially centrally within the container 2. An electric grill 41 is also located within the container 2 around the black light source 40. The electric grill 41 electrocutes the insects when they come into contact with it. Thus the electric grill 41 acts in combination with the CO₂ gas and the liquid to kill the insects. The black light source and grill 45 are components

which are well known in the art and according will not be described in further detail.

In use, the CO₂ gas flowing from the bottle 20 is opened to permit CO₂ gas to flow into the solution in the tray 3. Typically this is done early in the morning, eg 4.00 a.m. to 7.30 a.m. when there are not many people around outside in proximity to the container 2. The CO₂ gas and sucrose containing solution or brew as well as the light act as a bait or attractant to drawn flying insects into the container 2 through the openings 5 in the side wall 11.

This draws insects from the surrounding vegetation towards and into the container. Once inside the container the insects become dizzy and disorientated due the CO₂ which causes asphyxiation. Eventually they tire and fall into the solution in the tray 3 and drown. The surfactant in the solution in the tray lowers the surface tension of the liquid. This has the effect that the insects fall rapidly through the surface of the solution into the body of the solution.

The process of attracting insects to the container everyday and killing a "batch" of insects has the effect of clearing the surrounding vegetation of flying insects. As a result when social occasions are held in the evening the area has been effectively "cleared" of flying insects and they do not pose a problem.

From time to time the container is opened to clean out the tray. To do this the container is simply lifted off the tray.

Figures 2 and 3 illustrate apparatus in accordance with a second embodiment of the invention. As this embodiment is structurally and functionally very similar to the figure 1 embodiment the same reference numerals will be used to refer to the same components unless otherwise indicated.

The container 2 has a closed top and an open bottom which is received in the solution containing receptacle 3. Figures 2 (a) and (b) show respectively a front elevation and a plan view of the container 2. Figures 2(c) and (d) show respectively a front view and a plan view of the receptacle 3

which is a tray. Figure 3 then shows the open bottom of the container 2 received in the tray 3.

The other components in the container, eg the black light 40 and electrical grill 41 are the same as in the Figure 1 embodiment and accordingly will not be described further. Similarly the gas or CO₂ supply from a gas bottle are a gas pipeline is typically the same as described with reference to figure 1.

Figure 3(a) shows the terminal end of the CO₂ pipe at the bottom of the container 2 with CO₂ gas bubbling or percolating up through the solution.

Figure 3(a) also shows a plug for energising the light 40 and grill 41 which in use is plugged into a power point. It also shows a guard 61 surrounding the grill 41. It also shows a brass ring 50 for suspending the container and key holes 51 for suspending the tray 3.

Figures 4 and 5 show apparatus in accordance with a third embodiment of the invention. Again this embodiment is structurally and functionally very similar to the early embodiment and accordingly the same reference numerals will be used to refer to the same components unless otherwise indicated.

The main difference between this embodiment and the figure 2 embodiment is the structural makeup of the container 2 and receptacle 3. In figure 4 the container 2 has a closed bottom and an open top. The closed bottom of the container forms the receptacle 3. A removable lid 60 is mounted on the open top of the container 2 closing off the container 2 during operation of the apparatus but also providing access to the interior of the container 2.

The power grill 41 and black or red lights 40 are mounted to the lid 60, depending downwardly from a central region thereof. A guard formation 61 extends downwardly circumferentially around the power grill and light 40.

The openings in the container 2 are formed by a cluster of small openings 45 formed in each surface of the container 2 rather than a gore or

mesh stretched across a window-like opening.

Figure 5 illustrates a sectional view of the assembled apparatus.

Figures 6 and 7 illustrate apparatus in accordance with a fourth embodiment of the invention. The apparatus comprises broadly a container shown in figure 6(b) engaging an upwardly opening receptacle as shown in figure 6(a). The assembled apparatus is shown in figure 7.

The main difference between this embodiment and the figure 2 embodiment is the fact that the terminal end of the container 2 does not rest on the floor of the receptacle 3. Instead the container 2 and receptacle 3 have complementary engagement formations 70 and 71 permitting their releasable attachment to each other end-to-end. The receptacle 3 is made of deformable plastics material enabling the walls thereof to be pulled laterally outwardly out of engagement with the complementary container formations 71 to permit detachment therefrom.

Figures 8 and 9 illustrate apparatus in accordance with a fifth embodiment of the invention. The apparatus is structurally and functionally very similar to the earlier embodiments and the following description emphasises the differences between this embodiment and the earlier embodiments.

The apparatus comprises broadly a closed container 2 having a base 80- which is detachable from the rest of the container 2 and a discrete receptacle which is a tray 3 supported on the base 80 within the container 2.

The upper part of the container 2 and the base 80 have complementary engagement formations typically in the form of male/female formations (not shown) such that they are attached to each other by means of a releasable press fit.

The container 2 has at least one removable closure 82 mounted on the side wall thereof approximate to the cluster of openings 45. The closure 82 provides access to the interior of the container when this is required without detaching the container from the base.

The power source for the apparatus may be a low voltage DC power source derived from batteries, solar panels, or a rectified and transformed AC power

source.

The process of attracting insects into the chamber of the apparatus and the distribution of CO₂ may be improved by incorporating a centrally positioned electric fan.

5 The lighting within the chamber may be provided by or include a diode light @ 2000 Lumen 520 – 560 manometers spectrum red, green and blue.

The CO₂ gas flow may be pulsed for more effective gas usage.

10 The provision of an electric heater within the chamber may also improve the attracting and kill performance of the apparatus.

The water based solution within the container may include additives such as octonol Lactic acid and Cetol acid.

15 The apparatus described above with reference to the drawings has been found to be extremely efficacious in reducing the problems caused by flying insects. It can be easily manufactured and supplied to the market at reasonable cost. It is also reasonably easy for a lay user to operate satisfactorily and to maintain it properly.

20 It will of course be realised that the above has been given only by way of illustrative example and that all such modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as is herein set forth.

25 Aspects of the present invention have been described by way of example only and it will be appreciated that modifications and additions thereto may be made without departing from the scope thereof as defined in the appended claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Apparatus for killing flying insects including:
a container having a side wall and defining at least one opening
in the side wall;
5 means for attracting and drawing flying insects into the
container in through the opening; and
a liquid receptacle positioned towards the bottom of the
container for drowning insects caught within the container.
2. Apparatus as claimed in claim 1 wherein the attracting means
10 includes CO₂ gas.
3. Apparatus as claimed in claim 2 wherein the attracting means
also includes a liquid which is a water based solution including a sugar, eg
fructose or sucrose and optionally also chlorophyll, through which the CO₂
gas is bubbled or percolated.
- 15 4. Apparatus as claimed in claim 3 wherein the water based
solution also includes a surfactant for reducing the surface tension of the
solution such that the insects easily fall through the surface and drown in the
body of the solution.
5. Apparatus as claimed in any one of claims 1 to 4 wherein the
20 attracting means also includes a light, eg a black or red light or optionally a
combination of the two within the housing.
6. Apparatus as claimed in any one of claims 1 to 5 wherein the at
least one opening in the side wall comprises at least one cluster or array of
closely spaced small openings defined in the side wall of the container.
- 25 7. Apparatus as claimed in any one of claims 1 to 6 wherein the
least one opening may be formed by at least one larger window like opening
in the side wall with gore or mesh stretched across the opening to define a
plurality of small openings.
8. Apparatus as claimed in any one of claims 1 to 7 including a
30 cylinder containing liquid CO₂ for providing the CO₂ gas to the container.
9. Apparatus as claimed in claim 8 wherein the cylinder is typically
coupled to a conduit which is passed into the solution in the receptacle in the

container such that emitted CO₂ bubbles through said solution.

10. Apparatus as claimed in claim 9 wherein the CO₂ cylinder and conduit include means for opening and shutting the flow of CO₂ gas into the container.

5 11. Apparatus as claimed in claim 10 wherein the opening and shutting means includes a solenoid, and optionally also a flow valve and a regulator positioned on the conduit.

12. Apparatus as claimed in any one of claims 8 to 11 including a timer operatively connected to the opening and shutting means for causing
10 CO₂ to flow into the container only at certain specified times of the day.

13. Apparatus for killing flying insects including:

a container defining at least one opening;

means for attracting flying insects into the container through the opening; and

15 means for drowning the insects in the container.

14. Apparatus as claimed in claim 13 including means for disorientating the insects in the container.

15. Apparatus as claimed in claim 14 wherein the disorienting means includes CO₂ gas in the air within the container which subjects the
20 insects to asphyxiation.

16. Apparatus as claimed in any one of claims 13 to 15 wherein the container is closed and the attracting means comprises a liquid brew having an odour which diffuses into the air outside the container.

17. Apparatus as claimed in claim 16 wherein the brew is a liquid
25 solution of water and sugar.

18. Apparatus as claimed in any one of claim 13 to 17 wherein the means for attracting insects includes CO₂ gas, which is bubbled through the liquid solution so that it acquires taint from the liquid.

19. Apparatus as claimed in any one of claims 13 to 18 wherein the
30 means for drowning the insects comprises a body of liquid positioned below the region of the container for receiving the flying insects and liquid solution also forms the body of liquid within which the insects are drowned.

20. A method of killing flying insects including:
luring and/or drawing flying insects into a container;
disorientating the insects in the container; and
drowning the insects in the container.

5 21. A method as claimed in claim 20 wherein there is provided an
attractant for use in attracting and killing flying insects, the attractant including
a water-based solution containing sugar.

22. The method of claim 21 wherein the sugar is a fructose or
sucrose sugar which is dissolved in the water.

10 23. The method of claims 21 or 22 wherein the attractant includes
CO₂ in the form of CO₂ gas is bubbled through the water.

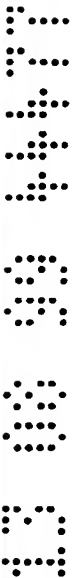
24. The method of any one of claims 21 to 23 wherein the solution
also includes a surfactant and chlorophyll.

DATED this 13th day of August 1999

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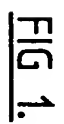


Figure 6 shows the results of the analysis of variance. The main effect of the number of trials was significant ($F(1, 10) = 7.98$, $p < .05$). The interaction between the number of trials and the type of feedback was also significant ($F(1, 10) = 10.45$, $p < .05$). The simple effects indicated that the mean error rate decreased as the number of trials increased, regardless of the type of feedback. However, the decrease in error rates was more pronounced in the condition with immediate feedback than in the condition without immediate feedback.

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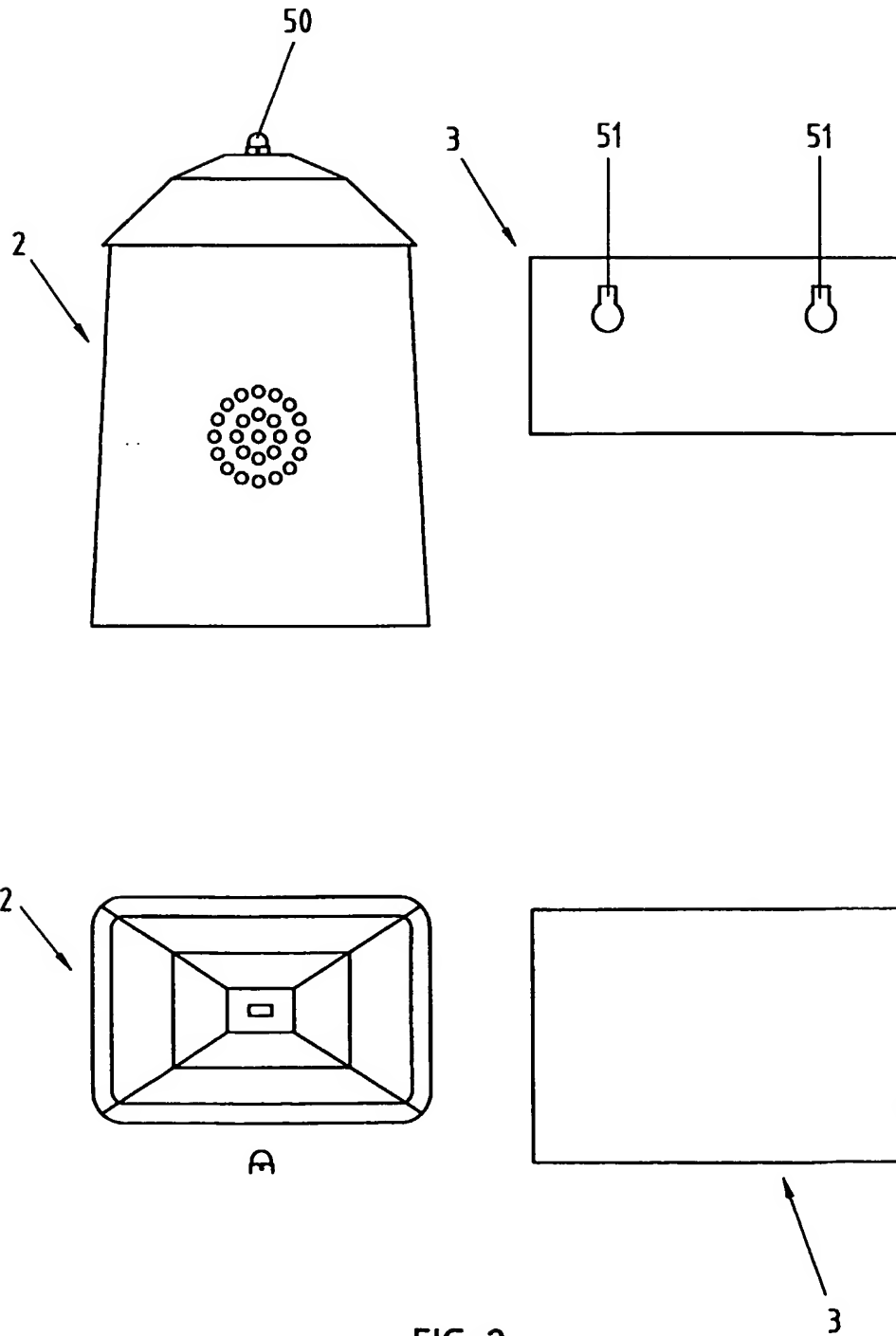


FIG 2.

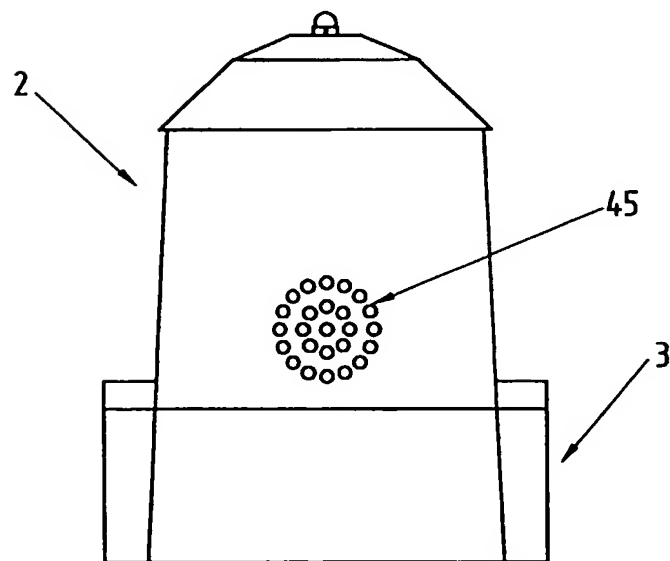
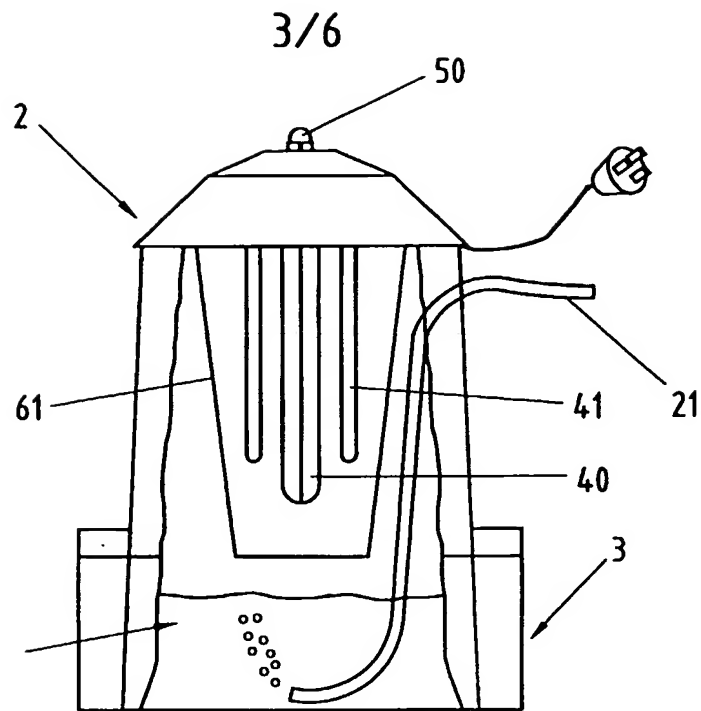
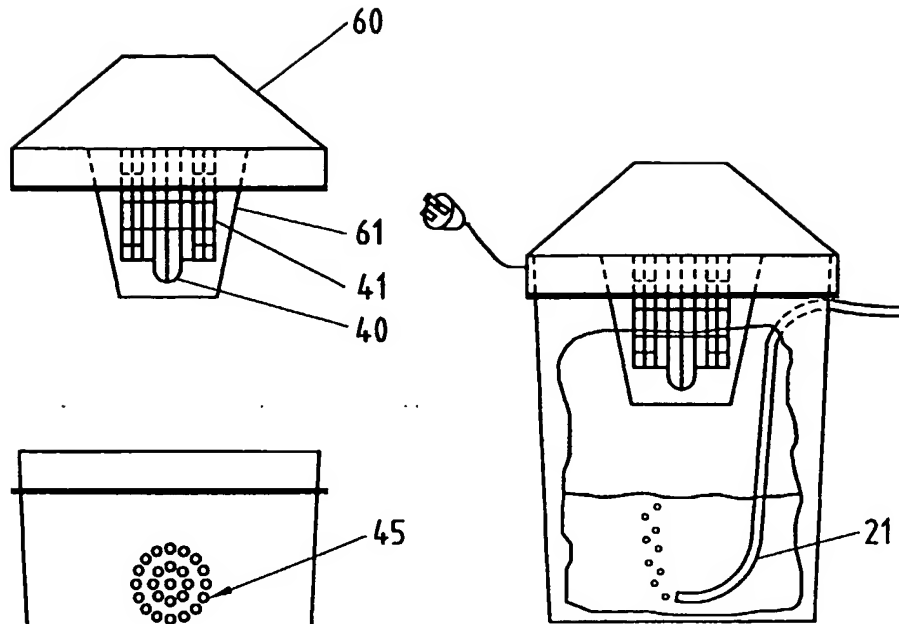
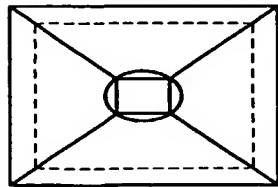


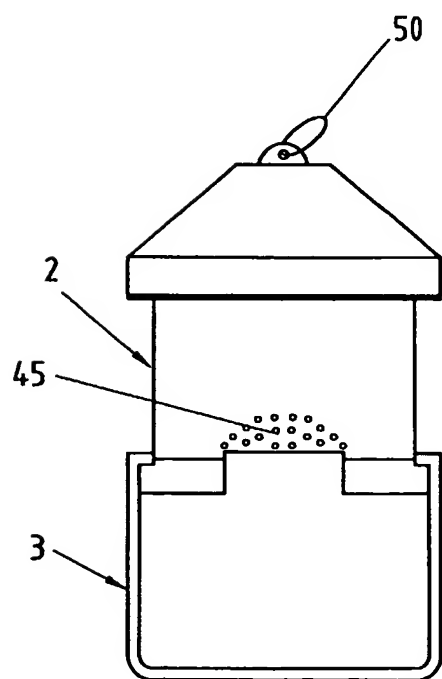
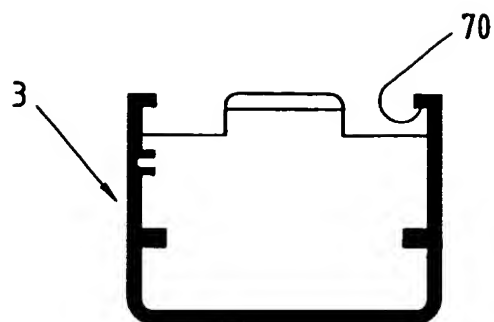
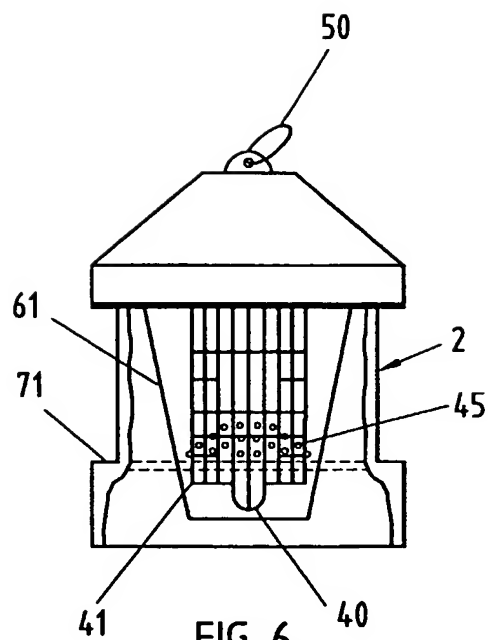
FIG 3.

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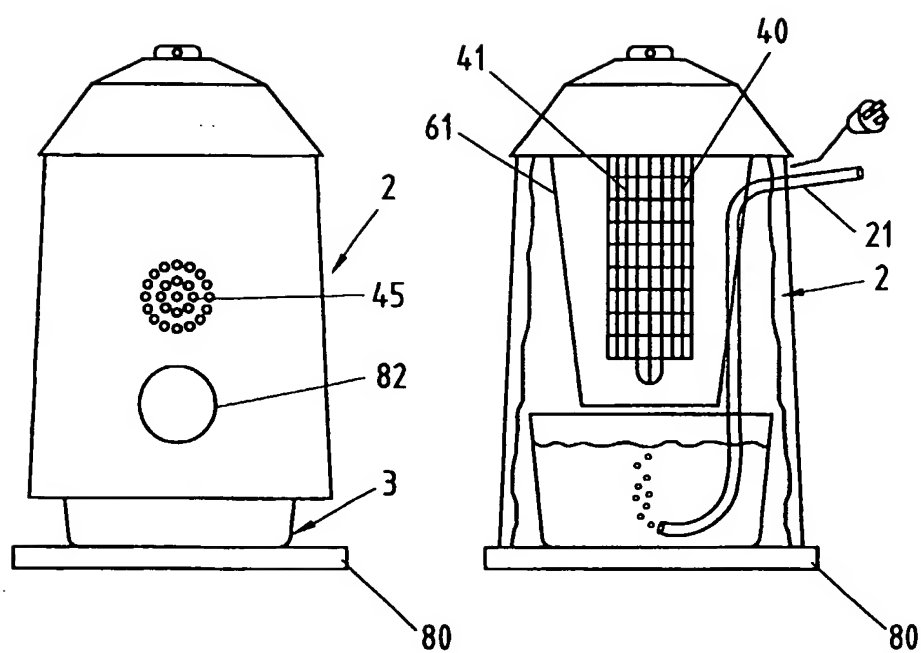
FIG 5.FIG 4.

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FIG 7.FIG 6.

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FIG 8.FIG 9.

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